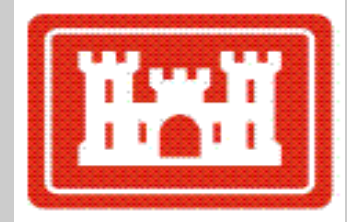


# Operational Range Assessment Program (ORAP) Phase II Overview

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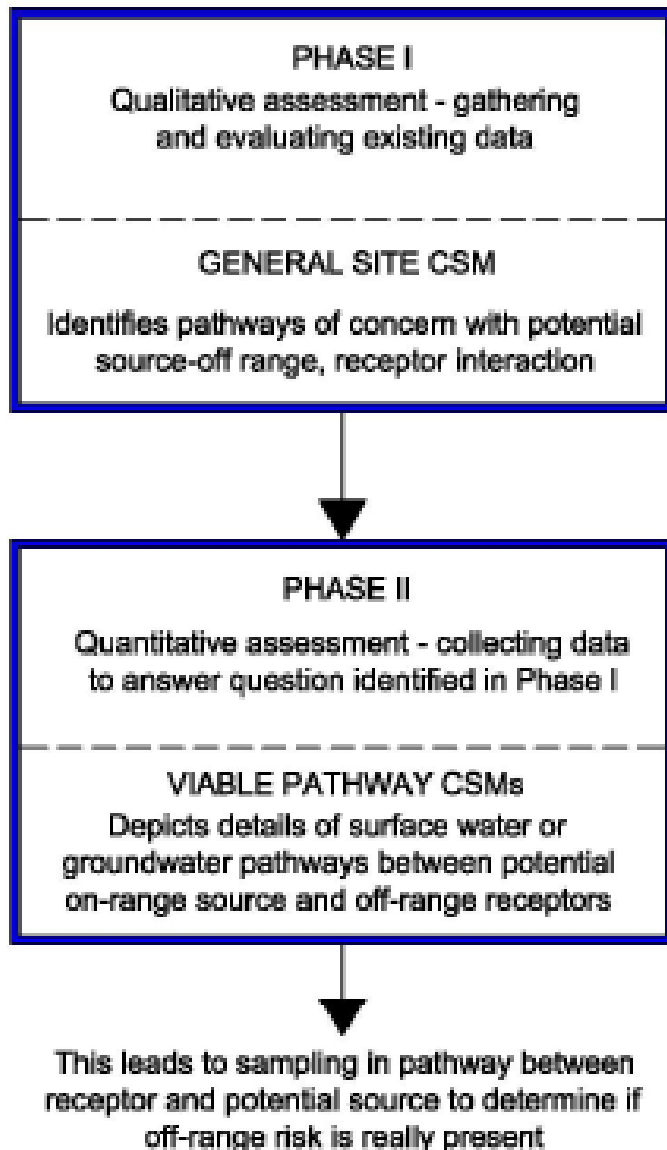
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# Operational Range Assessment Program Background

- Mission
  - Establish “information excellence” to support the Army’s Range Sustainment Program.
- Intent
  - Keep ranges open and available for testing and training.
  - Ensure people on and off Army installations are not drinking water contaminated by explosives.
  - Address regulatory and public concerns.





# ORAP Assessments use a phased approach and are based on Source – Receptor Interactions

# Phase II Quantitative Assessment

- U.S. Army Public Health Command (Provisional) Phase II Approach
  - Develop installation-specific HSP and APPs
  - Develop DQOs
  - Develop QAPPs using UFP-QAPP
  - Identify and address applicable SW and GW pathways only
  - Develop detailed Viable Pathway CSMs (discussion and illustration)
    - Incorporate non-range influences and degradation
    - Select effective sample locations
  - GW sampling at/near sources (not on impact areas) or exposure points
  - SW sampling
    - Account for temporal variability (wet/dry seasons, high/low flow events)
    - Use SW decision flow chart



# Phase II Quantitative Assessment

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- USAPHC (Provisional) Phase II Approach (continued)
  - Ecological Risk Assessments – aquatic receptors only
    - Background and 95% UCL of mean results vs. screening levels comparison
    - Benthic macroinvertebrate surveys – false Positive / Negative
  - Human Health Risk Evaluations
    - Initial data screening – direct comparison to screening levels
    - Quantitative data screening – determine need for HHRA
  - Referred categorization must be based on Risk Assessment results – not just on Phase II data



# Phase II ORAP

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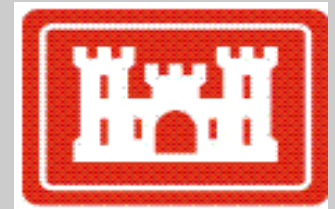
- ACSIM has overall Army responsibility for Operational Range Assessment Program including funding and guidance.
- G3 provides HQDA level operator input.
- AEC and NGB are the Program Managers for Phase II Assessments.
- USAPHC (Provisional) will provide technical oversight and QA.
- Contract mechanism for Phase II Assessments will consist of AE IDQ, Multiple Award Military Munitions, and Multiple Award Environmental Service contracts.
- Total number of Active and Reserve installations requiring a Phase II is 45 including the seven (7) pilot studies.
- Phase II completion date is 2014.



# ORAP Phase II Pilot

## USAG Fort Jackson / McCrady Training Center

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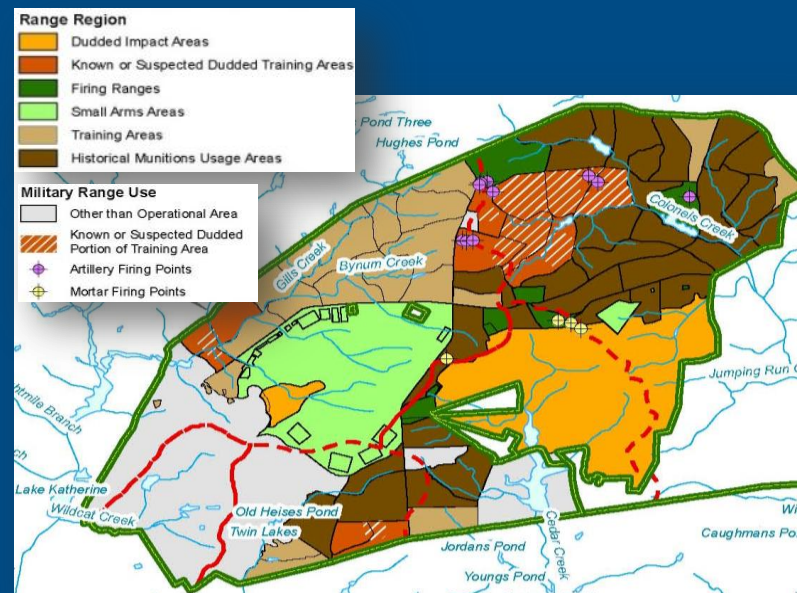
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# Installation Overview / Fast Facts

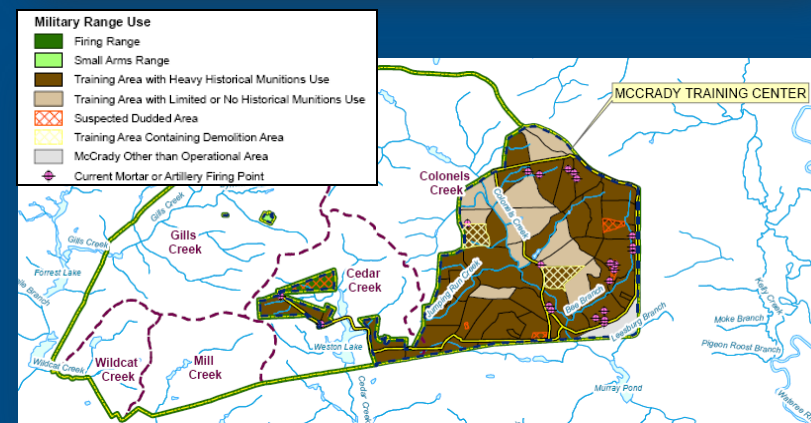
## ■ Fort Jackson -

- Army owned/operated 36,971 acres (+15,267 acres operated by SCARNG)
- Used 1917 to present for Basic & Advanced Infantry Training
- 29,475 operational acres / 16,471 categorized as Inconclusive\*
- 104 operational ranges / 51 categorized as Inconclusive



## ■ McCrady Training Center -

- Army owned/NGB operated
- 15,267 acres in total
- Used by SCARNG since 1943
- 14,895 operational acres / 12,243 categorized as Inconclusive\*
- 62 operational ranges / 48 categorized as Inconclusive\*



\* Inconclusive— Existing information is either insufficient to make a source-receptor interaction determination or indicates a potential for such interaction to be occurring.



# Surface Water System Study Overview

## Watersheds

- Gills Creek
- Colonels Creek
- Cedar Creek
- Mill Creek \*

## Sampling Events

- Wet Season A + B – April Storm - May
- Dry Season A + B - July



## Surface Water Analysis

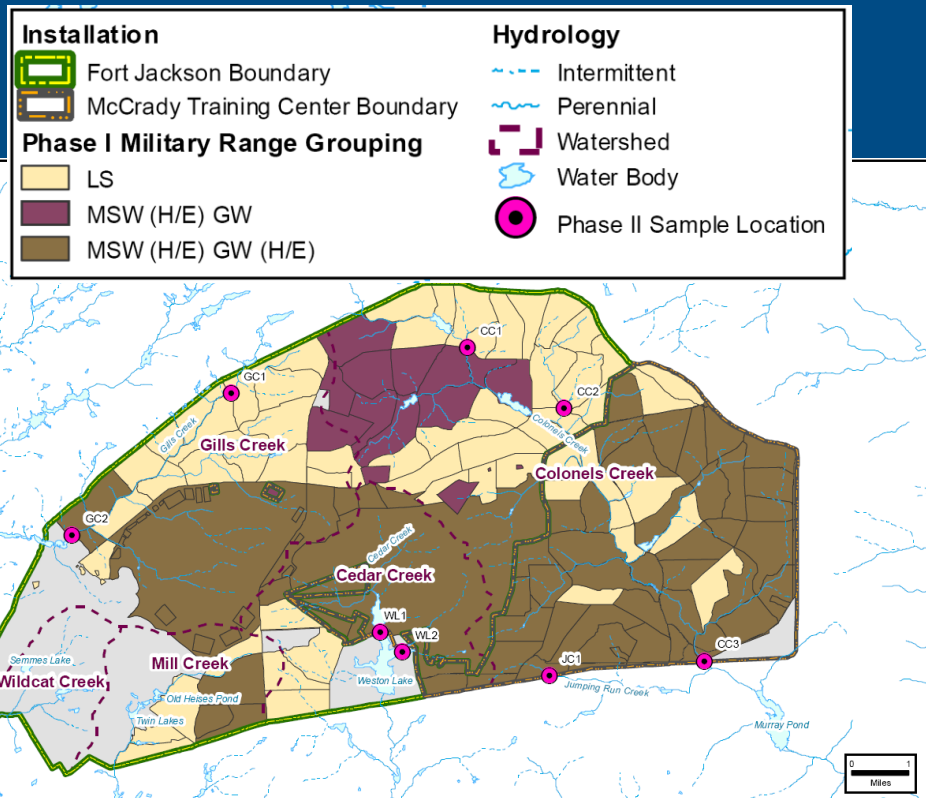
- Explosives by EPA 8095M
- Dissolved Metals by EPA 1638M
- Perchlorate by EPA 6850

## Sediment Analysis

- Explosives by EPA 8330A
- Metals by 6020A

## Benthic Macroinvertebrates

- Explosives by EPA 8330A
- Metals by 6020A



# Surface Water System Study Results

## Colonels Creek

- **Surface Water MCOC**
  - Antimony, lead, and zinc exceeded reference
  - None exceeded PAL at 95% UCL of mean
- **Sediment MCOC**
  - Copper, lead, and zinc exceeded reference
  - None exceeded PAL at 95% UCL of mean
- **Benthic Macroinvertebrates**
  - No indications of impairments

Surface Water and Sediment MCOC
Antimony
Copper
Lead
Tungsten
Zinc
1,3,5-Trinitrobenzene
1,3-Dinitrobenzene
2,4,6-Trinitrotoluene
2,4-Dinitrotoluene
2,6-Dinitrotoluene
2-Amino-4,6-Dinitrotoluene
3,4-Dinitrotoluene (SW Only)
4-Amino-2,6-Dinitrotoluene
4-Nitroaniline (SD Only)
HMX
m-Nitrotoluene
Nitrobenzene
Nitroglycerine
o-Nitrotoluene
Perchlorate (SW Only)
p-Nitrotoluene
RDX
Tetryl

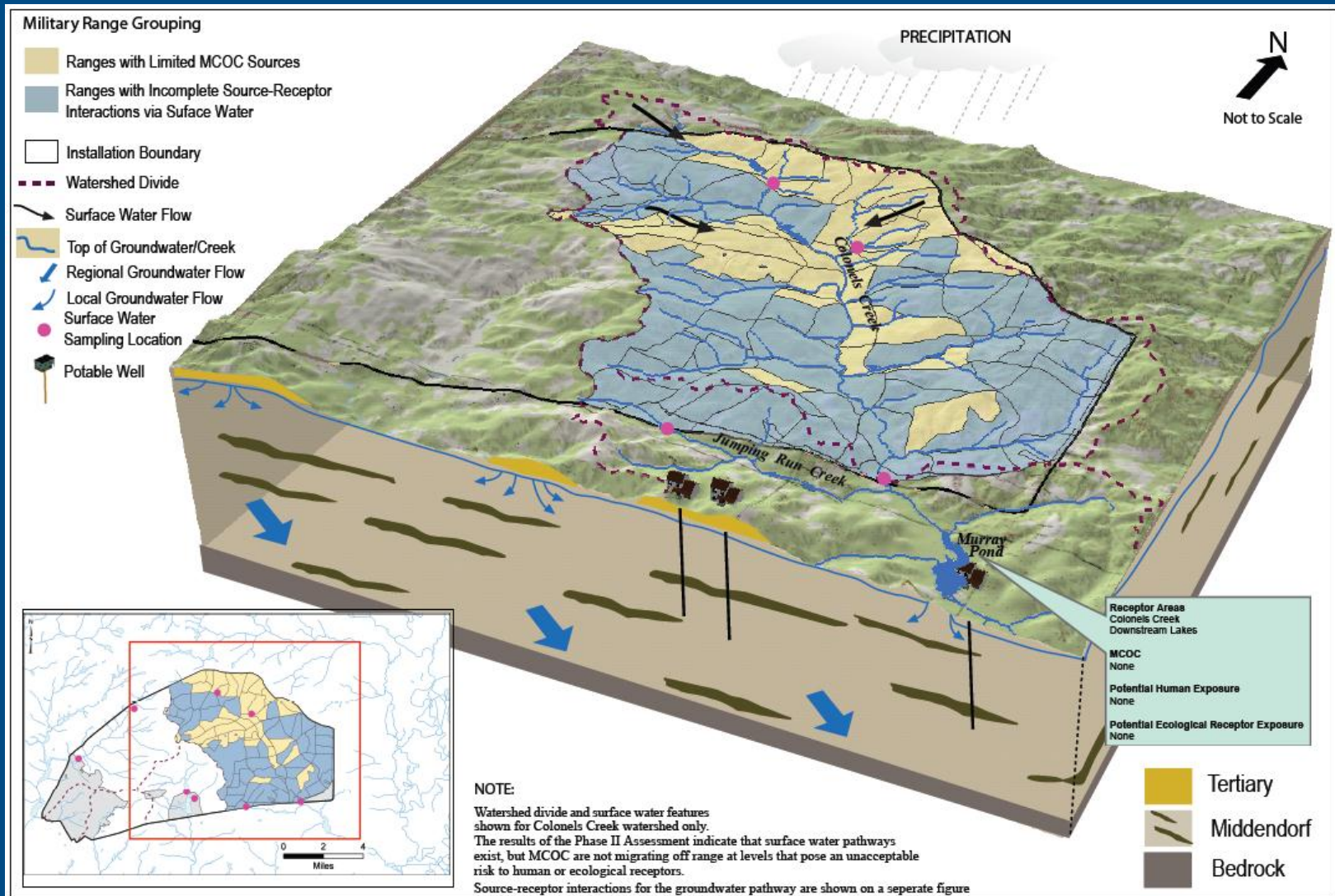
MCOC Exceeding Reference
<b>Surface Water</b>
Antimony
Lead
Zinc
<b>Sediment</b>
Copper
Lead
Zinc

MCOC Exceeding Project Action Levels at 95% UCL of the mean
<b>Surface Water</b>
None
<b>Sediment</b>
None



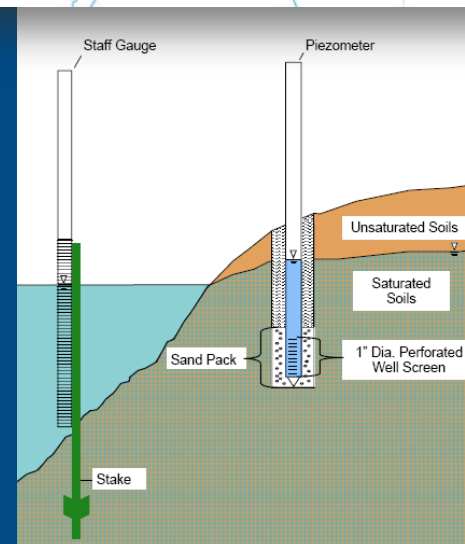
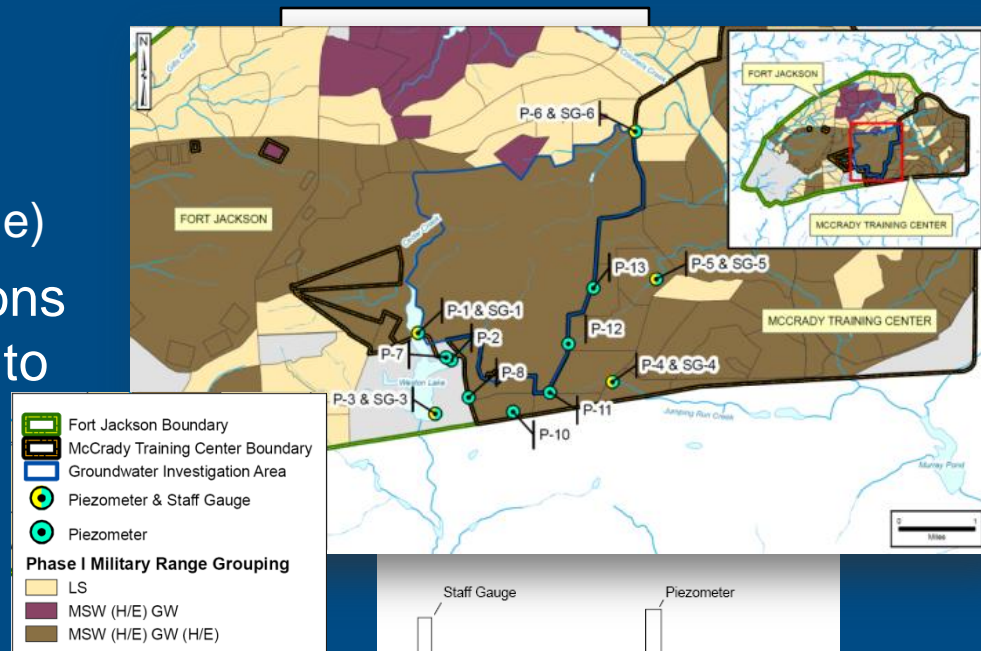
# Surface Water System Study Findings

## Colonels Creek Conceptual Site Model



# Groundwater System Study Overview

- Worst-Case Groundwater Investigation Area (Blue Outline)
  - Worst-Case based on munitions type and loading, & proximity to receptors
- 2 Stages
  - Stage I (30 March – 20 May 2009):
    - 7 Piezometers
    - 5 staff gauge / piezometer pairs
    - Groundwater elevation measurement



# Groundwater System Study Overview

## Stage II (27 May – 10 June 2009)

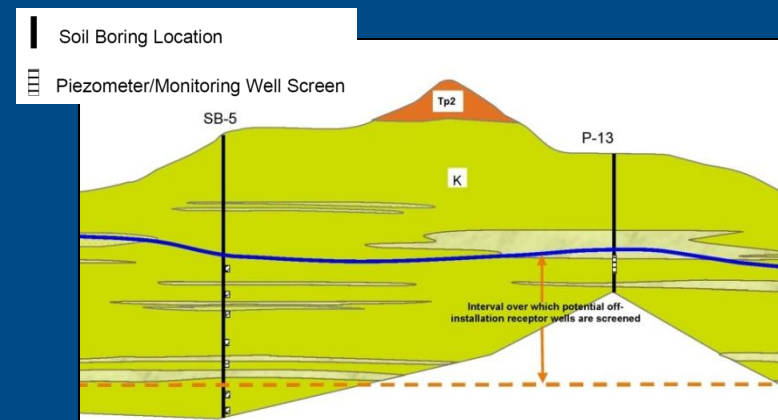
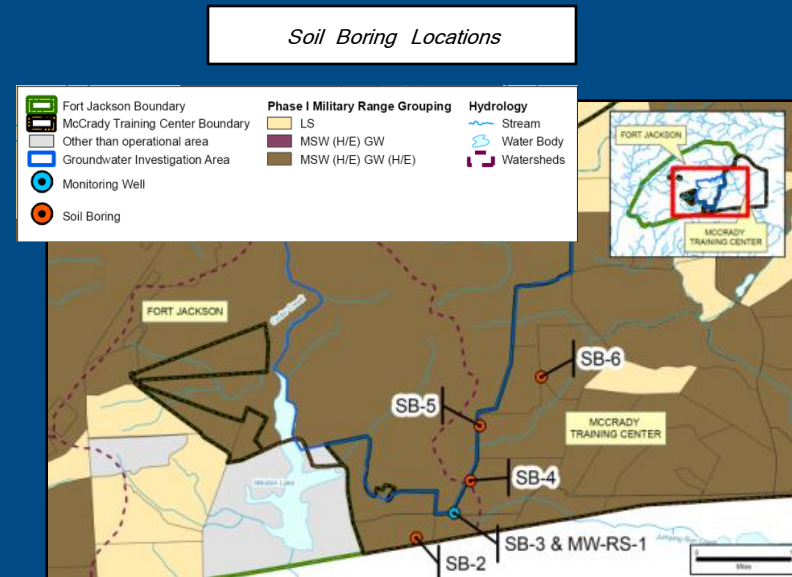
- 5 Soil Borings and 1 Deep Monitoring Well
- 26 depth-discrete groundwater samples
- 20-foot intervals to approximately 150 feet AMSL
- One existing supply well sampled
- Analyses

### MCOC

- Explosives by EPA 8095M
- Perchlorate by EPA 6850
- Total and dissolved metals (antimony, copper, lead, zinc, and tungsten) by EPA 200.8

### Water Quality

- Hardness metals (calcium and magnesium) plus sodium by EPA E200.7
- Anions (sulfate, chloride, and nitrate) by EPA 300.0
- Alkalinity by EPA 310.1/SM2320B
- Total dissolved solids (TDS) by SM2450C





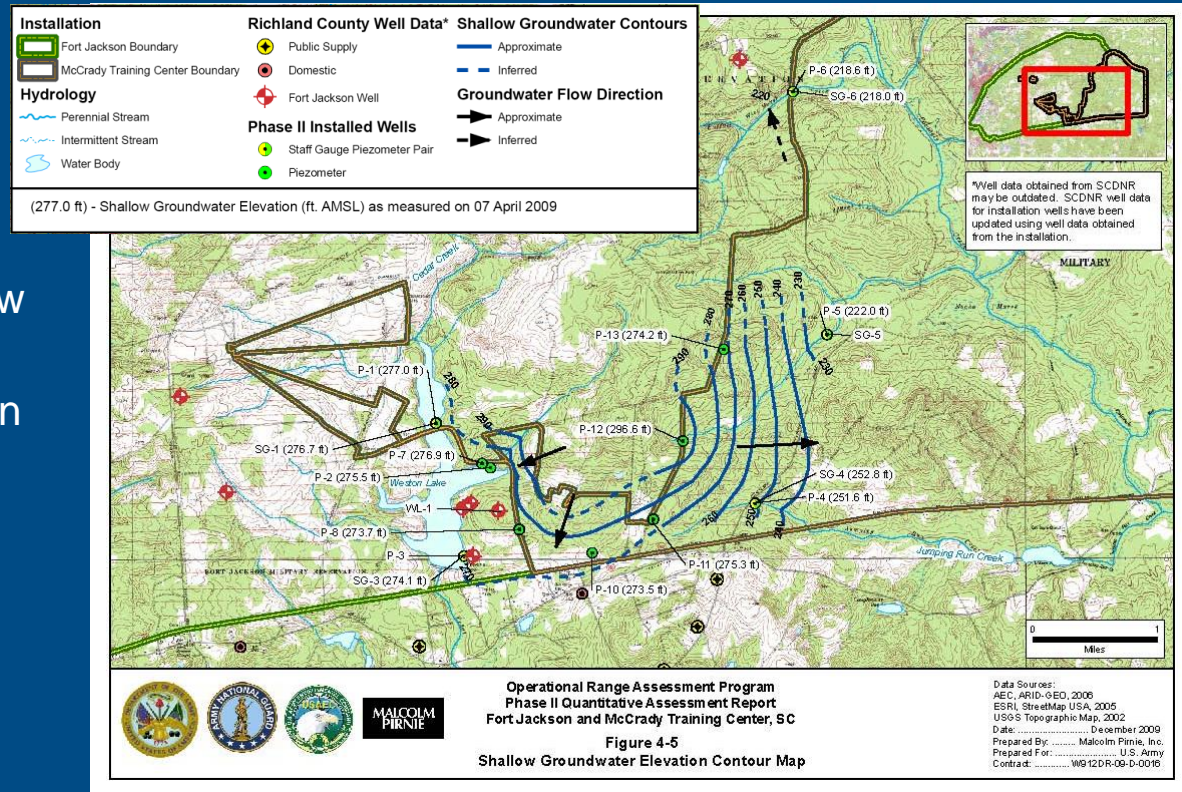
# Groundwater System Results

## ■ Geology

- Predominantly sand (fine- to medium-grained, sub-angular quartz, micaceous zones)
- Frequent clay units, laterally discontinuous upper, potentially continuous lower clay unit present in all 5 soil borings

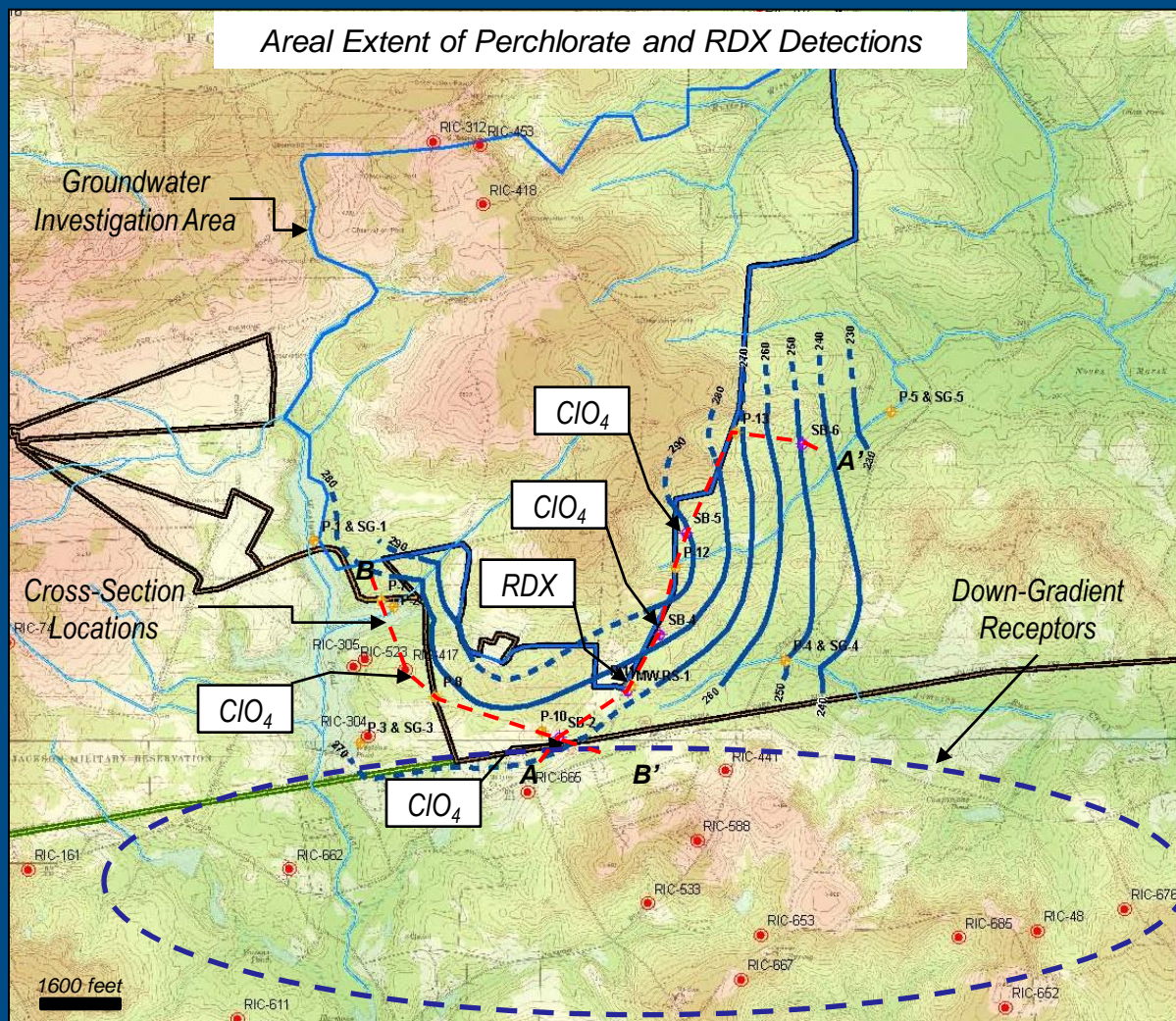
## ■ Shallow Groundwater Flow

- Topography controlled flow
- Radial flow west, south, and east from investigation area
- Discharge of shallow groundwater to low order streams (Cedar Creek, Colonels Creek, Jumping Run Creek)



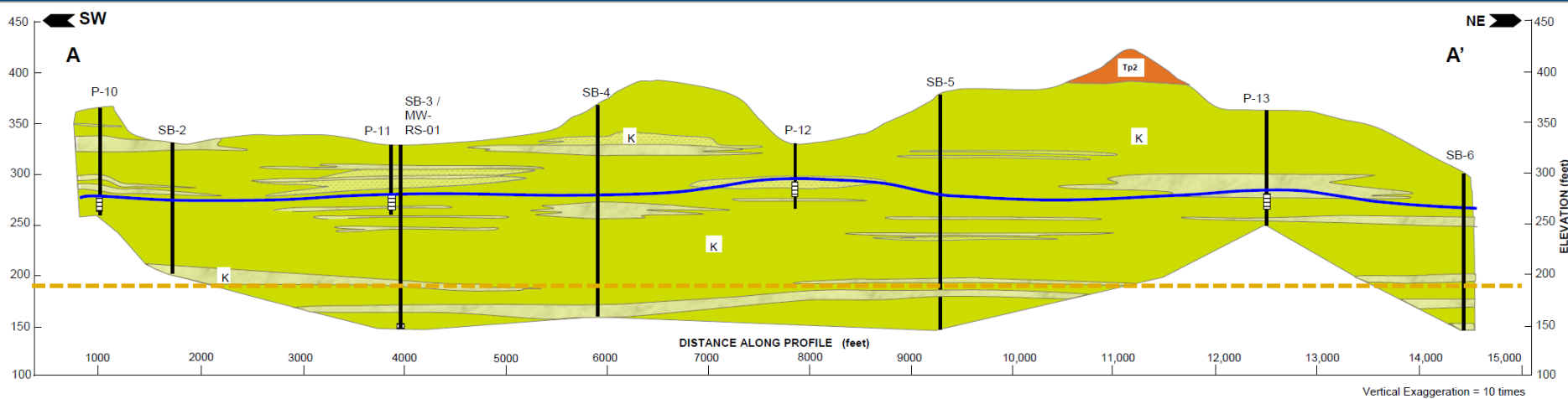


# Groundwater System Results





# Groundwater System Results



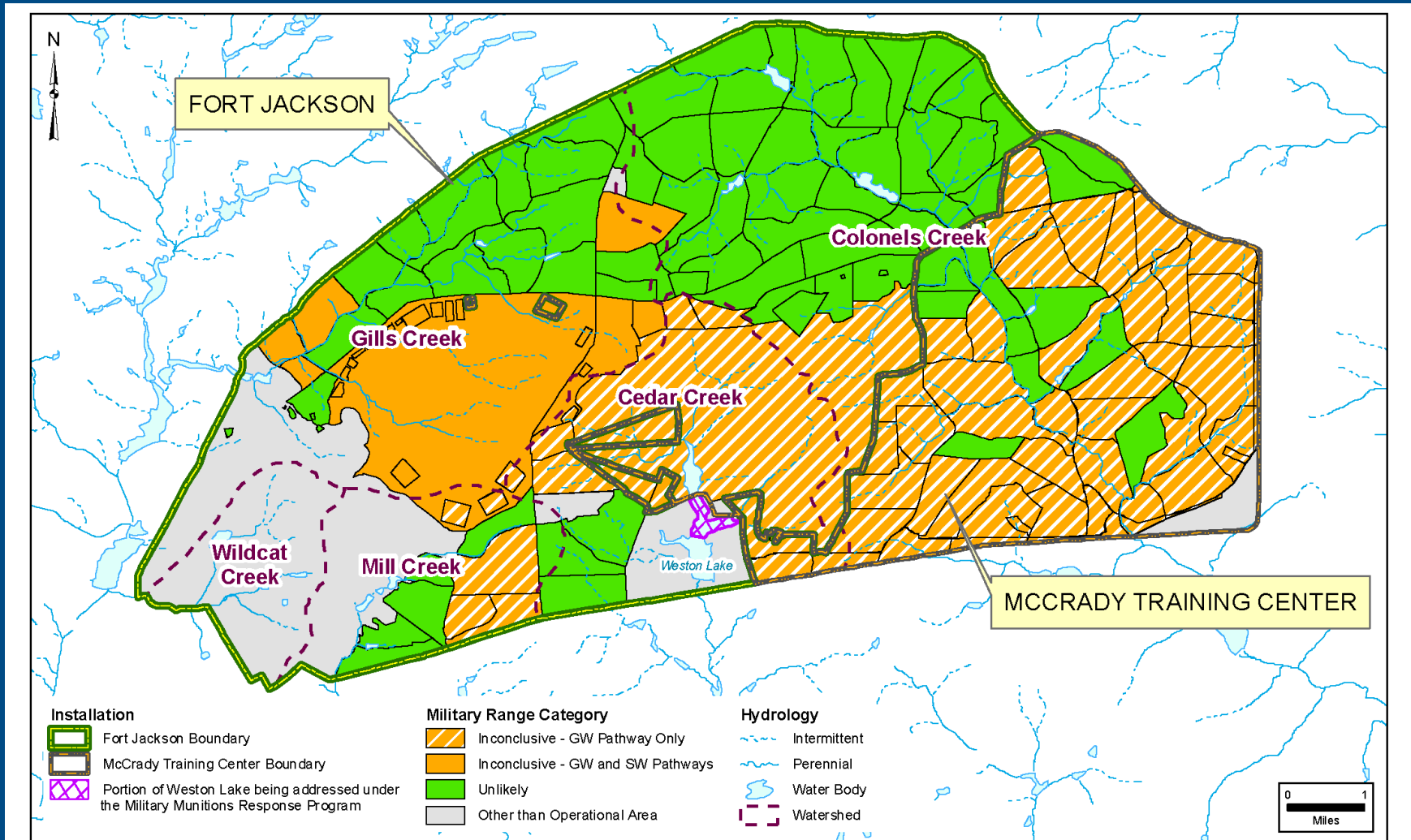
## ■ RDX:

- 29 Samples Collected
- 3 Detections in soil boring SB-3
- 0.064  $\mu\text{g/L}$  to 0.17  $\mu\text{g/L}$
- All < PAL (6.1  $\mu\text{g/L}$ ) but 2 above LRU (0.1  $\mu\text{g/L}$ )

## ■ Perchlorate:

- 29 Samples Collected
- 7 Detections in 3 soil borings (SB-2, SB-4, and SB-5), and Weston Lake Well
- 0.11  $\mu\text{g/L}$  to 0.21  $\mu\text{g/L}$
- All < PAL (15  $\mu\text{g/L}$ ) and <LRU (9  $\mu\text{g/L}$ )

# Overall Phase II Recommendations – Fort Jackson/McCrady Training Center



*Phase II Recommendations*



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# ORAP Phase II Pilot

## Fort A.P. Hill

Dave Mercadante

EA Engineering, Science, and Technology

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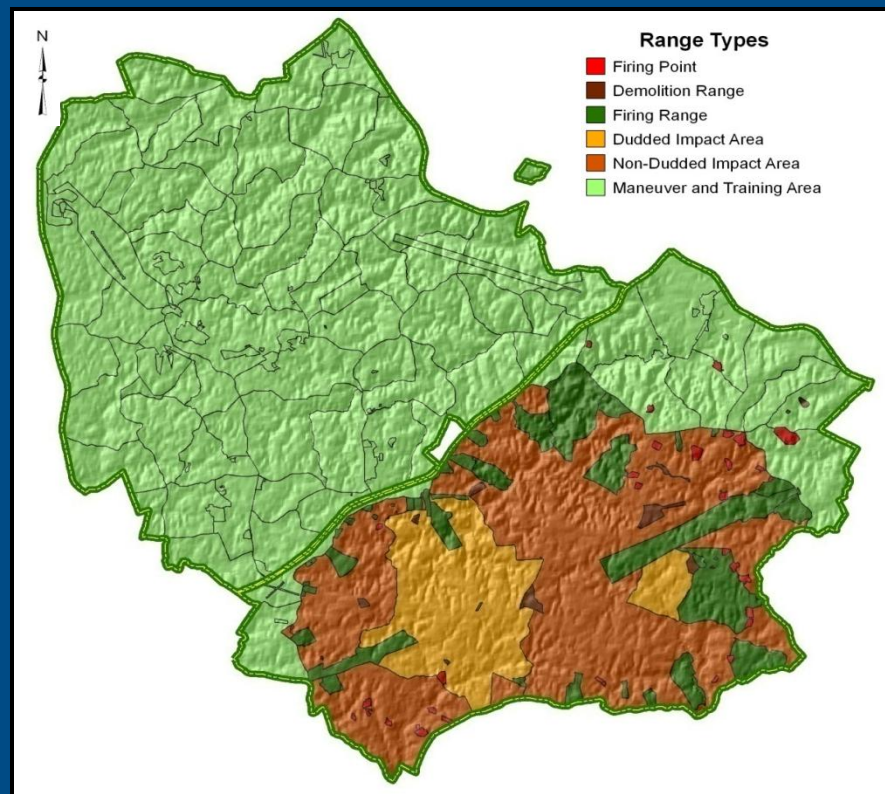
# Installation Overview / Fast Facts

## *Fort A.P. Hill, Virginia*

- *U.S. Army owned/operated*
- *Active since 1941*
- *228 operational ranges*
- *74,262 acres*

## *Phase I Conclusions*

- *Unlikely – 128 operational ranges, 47,641 acres*
- *Inconclusive - (insufficient info regarding off range source-receptor interaction) 100 operational ranges, 26,621 acres*



# *Piloting the Protocol*

- The identified sources, pathways, and receptors at installation allow full implementation of Technical Protocol
  - Training history means typical programmatic constituents potentially present on site
  - Main programmatic transport pathways identified from multiple source types
    - Well defined surface water flow and discharge points for multi-seasonal sampling
    - Groundwater sampling at both source discharge and potential exposure points
    - Habitat conditions present for testing application of benthic macroinvertebrate dip net sampling
- Site location allows comparisons of protocol application between Fort A.P. Hill and USAPHC pilot site in Virginia
- Site is easily accessible for evaluation by USAEC, USAPHC, and USACE program managers and technical oversight





# Surface Water System Approach

- Worst Case Approach - Heaviest Usage
- Multi-Seasonal Sampling Events
- Five Representative Watersheds
- Weight of Evidence Evaluation

BMI Composite Samples



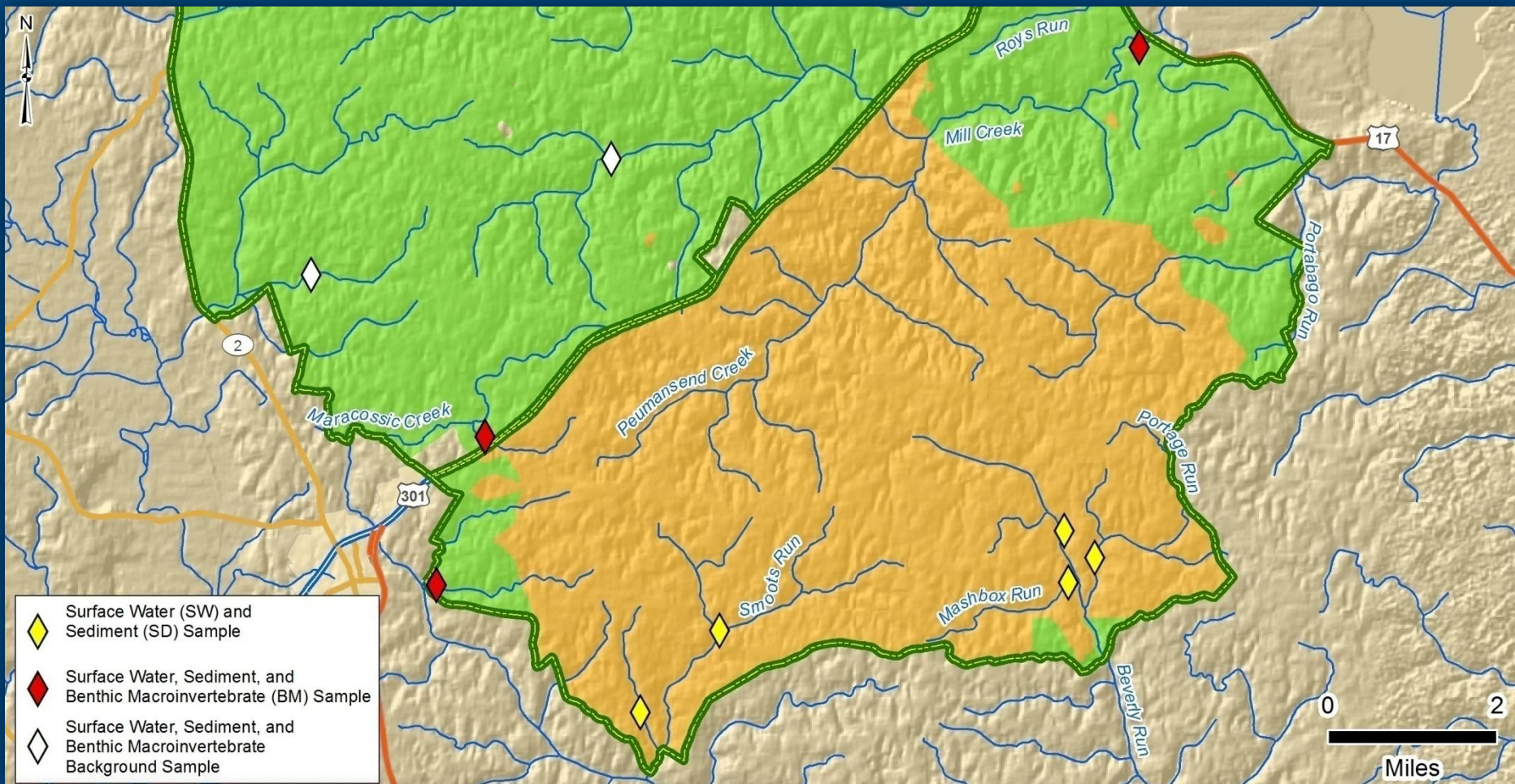
Composite Surface Water Samples



Composite Sediment Samples



# Surface Water System Approach



# *Surface Water System Results*

**Surface Water** - 95 UCLM for all analytes below background and/or human and ecological screening criteria at range/installation boundary

**Sediment** - All analytes below background and/or ecological screening criteria at range/installation boundary.

**Benthic** -Diverse, optimal habitats identified - no statistical difference versus background – critters are just fine

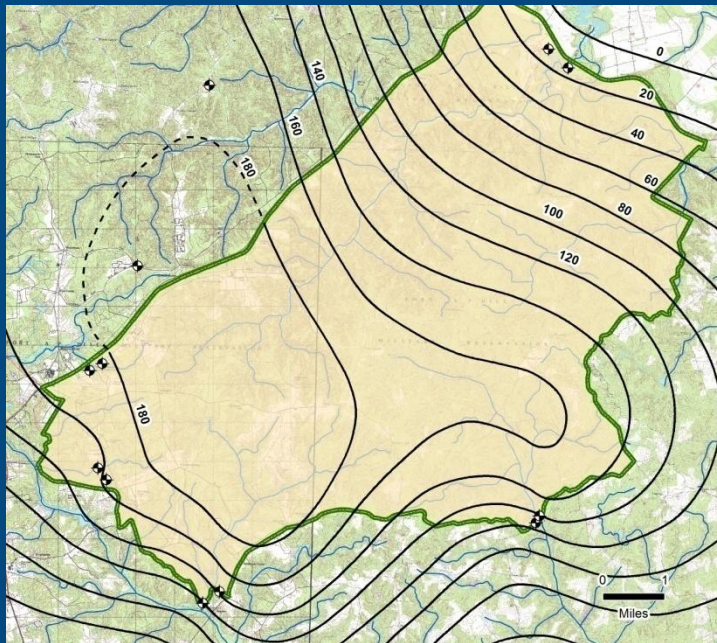


Recent training below sampling locations adds new source component  
Currently revising technical approach to evaluate new source



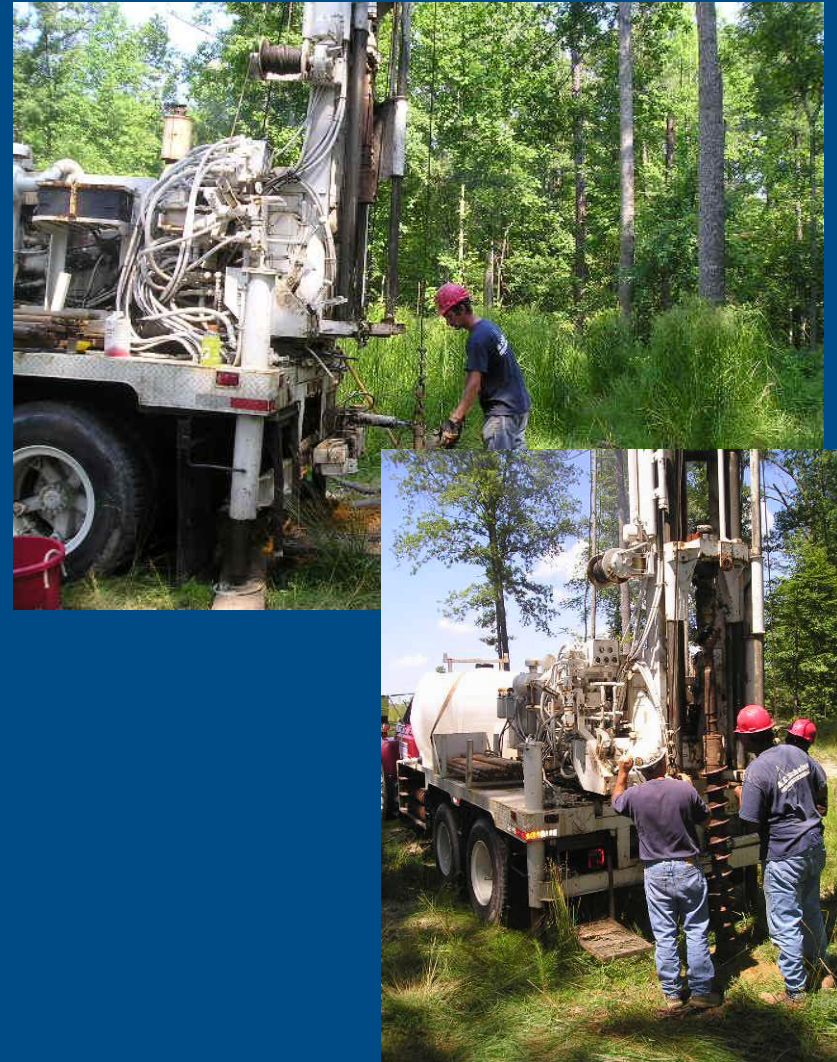
# Groundwater Approach

- Surficial aquifer wells at installation boundary designed to mimic potential receptor wells – 2 Wells per watershed
- Existing deeper production wells sampled to evaluate potential surficial to deep migration – 4 Wells



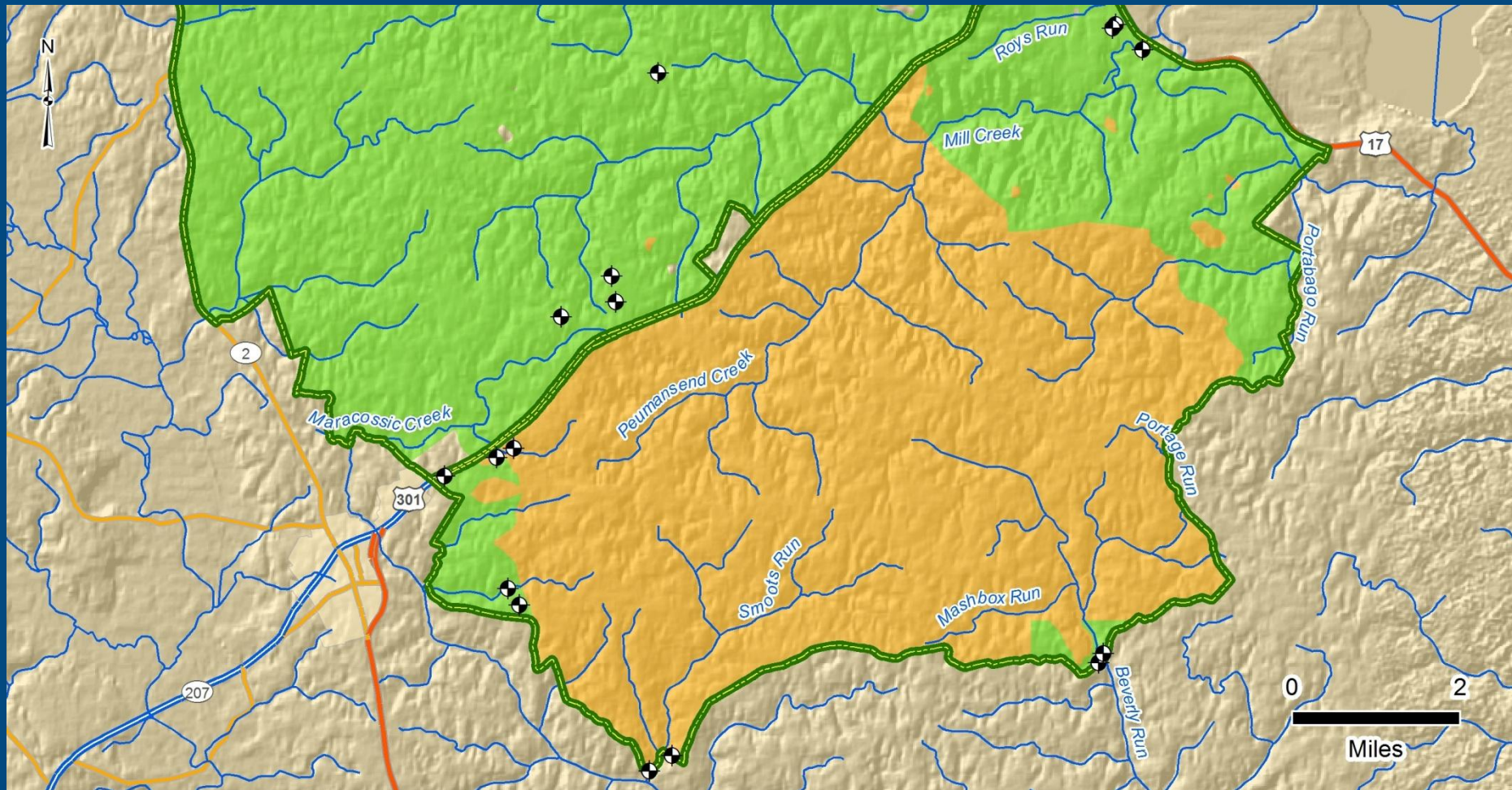
Refined Shallow Aquifer CSM

Surficial Aquifer Wells





# Groundwater Approach



## Installation Data

Installation Boundary

## Range Category

Unlikely

Inconclusive

## Transportation

Interstate

Highway

Major Road

## Hydrology

Rivers and Streams

Well



# *Groundwater Results*

All transportable analytes below background and/or human screening criteria at range/installation boundary in surficial aquifer and within the deeper production wells

Lithology indicated low hydraulic conductivity in surficial aquifer even near surface water bodies

Data evaluation complete – report development underway



# Lessons Learned in Proving the Concept

- Application of Worst Case Scenario application
  - Similarities in models of source, pathway, and receptor between watersheds allowed for a focused approach
- Establishing a baseline for storm event sampling
  - Installation of rain gauges, transducers and barometers in multiple watersheds identified parameters necessary for true storm transport
- Comparison of multi-seasonal benthic sampling results
  - Multi-seasonal approach added value – very dry “dry” season
  - BMI habitat and SEM-AVS sediment analysis provided additional weight of evidence to support analytical data
- Benefits of USEPA Method 1638 – only method to achieve QL 3x below screening criteria at site specific hardness

